FINAL SL-4 R+10 DAY MISSION EVALUATION REPORT (MEDICAL EXPERIMENTS)

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PREPARED FOR

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PREFACE

This report is submitted in accordance with the approved Memorandum modification (DB4/73/174) to the MSC Skylab Experiments Document, Scientific Analysis and Reporting Plan, July 14, 1974, MSC-03022.

This Ten-Day Report is a formal reporting requirement containing initial reportable operational information for the purpose of expediting dissemination of the information to participating organizations having to prepare additional working correspondence.

A. General Mission Summary

The Skylab 4 mission was launched on November 16, 1973, at 0801 c.d.t. and was terminated on February 8, 1974, at 1017 c.d.t. The duration of this mission which was flown by Astronauts Lt. Col. Gerald P. Carr (CDR), Dr. Edward G. Gibson (SPT), and Lt. Col. William R. Pogue (PLT) was 85 days, 4 hours, and 16 minutes. Sixteen (16) principal medical experiments were planned and executed. An additional number of special medical tests were conducted tangentially to the planned experiments. This report represents the third and last of a series of Ten-Day mission evaluation reports. One has been issued for each of the prior manned Skylab missions.

B. Experiment Operations Summary

Several medical experiment accomplishment summaries appear in this document. Section II contains a summarized medical operational chronology; Section III contains a review of experiment and special testing accomplishments; and Section IV summarizes equipment and procedural difficulties and anomalies. This assessment of accomplishments spans the SL-4 crew's preflight phase and the first seven days after recovery. The findings are preliminary and may be revised as successive analyses are completed. Clinical and experiment data discussions are excluded and shall appear in an LSD SL-4 Medical Report.

Medical mission accomplishments are grouped as follows:

- a. MO71 Mineral Balance
- b. MO73 Bioassay of Body Fluids
- c. MO74 Specimen Mass Measurement Device
- d. MO78 Bone Mineral Measurement
- e. MO92 Lower Body Negative Pressure
- f. MO93 Vectorcardiogram
- g. MilO series Hematology and Immunology
- h. Ml31 Vestibular Function
- i. Ml33 Sleep Monitoring
- j. Ml51 Time and Motion
- k. M171 Metabolic Activity
- 1. M172 Body Mass Measurement Devices
- m. Other Special Tests

Experiments MO71, MO73, MllO series, and Ml51 depend on specimens and/or photographs collected during flight. These specimens and photographs are being processed. No operationally applicable analytical data are currently available. This condition applies also to several special tests. The following summaries relate to inflight accomplishments only.

1. MO71/MO73

The collection of urine, feces, vomitus, and measurements of diet residue, and the recording of menu deviations for

experiments MO71 (Mineral Balance) and MO73 (Bioassay of Body Fluids) were accomplished. Body mass measurements were made on each crewman every day. Due to a shortage of urine sample bags, it was necessary to interchange scheduled 24-hour urine pools with 36-hour pools just beyond the midpoint of the mission. Boric acid was used as a urine preservative to offset the impact of possible freezer malfunctions which never occurred. Special urine specific gravity measurements were performed on each crewman concurrently with the first four blood draws.

2. M074/M172

Experiments MO74 (Specimen Mass Measurement Device Calibration) and M172 (Body Mass Measurement Device Calibration) were accomplished three times on each device. Some of the Specimen Mass Measurement Devices' calibration masses were misplaced early in the mission and calibrations were limited to a 0-500 gm - 0 procedure. During the latter third of the mission, 16 mm DAC and still documentary photography were accomplished on these devices during normal and representative operations. Toward the end of the mission the Body Mass Measurement Device was used to determine insensible water losses occurring during sleep and during regulated exercise. Data from these measurements are expected to contribute to the postflight mineral balance studies. MO74 and M172 met 100% of their pre-mission requirements except for the effect of the loss of the MO74 cal masses.

3. мо78

This experiment consists of preflight and postflight testing only. These tests were performed as planned.

4. M092

The pre-mission flight plan required MO92 (Lower Body Negative Pressure) to be performed on each crewman every 3 - 1 days. MO92 began on MD5. When crew time became critical, the schedule was modified to every 4 + 0.-1 days. This schedule remained in effect through MD58 when the 3 - 1 day requirement was reinstituted. Twenty-two MO92 runs were made on the CDR and SPT; 23 on the PLT. MO92 was the test device for two special tests: 1) Post MO92 Limb Blood Flow (Cardiovascular test #2 using a blood pressure cuff to restrict venous blood return and test #1 which tested the capability of the subject's leg muscles to pump blood during a negative delta pressure) and 2) IR Facial Photos of the subject during the conduct of MO92. Limb Blood Flow tests were performed seven times on the CDR and PLT and six times on the SPT. Three abbreviated venous compliance tests were run on each crewman immediately following their last MO92 performance. Facial photo sessions were completed six times on the CDR and PLT and five on the SPT.

5. MO93

MO93 was scheduled with the same intervals as MO92. This schedule was satisfied with independent runs together with VCG data obtained from M171 runs. Each crewman had nine independent MO93 runs and twelve acceptable combined M171/M093 runs for a total of 21 vectorcardiograms with exercise.

VCG data were obtained from special instrumented crew exercises also. Discussions of these exercises appear under the M171 experiment and "Special Tests".

6. MllO Series

Blood samples were acquired 8 times from each crewman. Special crew hemoglobin (Hb) measurements were conducted in conjunction with each blood draw except for the last. With the addition of a special Hb on MD62, each crewman had eight hemoglobin determinations voice reported to the MllO PCS.

7. M131

M131 (Human Vestibular Function) had a pre-mission planning requirement for seven each Motion Sensitivity (MS) and Oculogyral Illusion (OGI) tests on each crewman together with three Spatial Localization tests per crewman. MS was accomplished five times by the CDR and four times by the SPT and PLT. OGI was tested six times on each crewman. Spatial Localization was run three times on each crewman. On Mission Days 73 and 74, the crew performed modified MS protocols.

Conventionally, M131-1 consists of OGI run followed by an MS run; however, on MD73 and MD74 the PI had requested the crew to conduct double MS tests - the first test in the CW direction and the second CCW. Protocols called for the rotating litter chair at 30 rpm with 150 crew head movements. Independent OGI runs preceded and followed the modified MS runs to prevent physiological interference.

8. Ml33

M133 (Sleep Monitoring) had been scheduled for eight performances; however, after the mission began, the FMT approved an additional ten runs on MD28 after the SPT had demonstrated that the electrode caps could be refurbished successfully. M133 continued a five-day scheduling through MD60. MD65 was scrubbed when the OWS experienced some elevated internal temperatures and the SPT slept in the cooler MDA. The schedule was picked up again on MD72; but the MD76 performance slipped to MD77 after a mild skin rash formed on the upper side of the SPT's neck.
M133 was closed out with consecutive runs on MD's 80, 81, and 82.

9. M151

Experiment M151 (Time and Motion Study) photography was accomplished as planned, together with four additional photographic sessions on M092/093/171 during the final stages of the mission. The latter sessions will be used to obtain end-of-mission crew task performance effects.

M171 (Metabolic Activity) had a pre-mission planning requirement for 12 experiment performances per crewman. This experiment began on MD5 also and achieved 100% of its scheduling objectives. Vital capacity measurements were accomplished as part of the crew checklist for each M171 performance. As a result of crew options, several instrumented physical training exercises at maximum work loads and also during treadmill exercise were recorded.

11. Special Tests

Several special medical tests were conducted during the mission. While most of the tests were specified in the pre-mission Mission Requirements Document, several were elevated to that status after the mission began. Many were listed in the SL-3 R+10 Day Mission Evaluation Report and have been tabulated again to provide a comprehensive summary. Brief descriptions of these itemized tests appear in Section III, Medical Operational Review.

- a. Environmental Microbiology
- b. Water Sample
- c. Iodine Monitoring
- d. Carbon Monoxide Monitoring
- e. Taste and Aroma Evaluation
- f. Food Package
- g. Atmospheric Volatile Concentrator
- h. Girth and Height Measurements and Crew Profile Photos

- (1) Girth Measurements
- (2) IR Anatomical Photo
- (3) Center of Mass Measurements
- i. Sweat Samples
- j. Blood Flow in Limbs
- k. Stereo Photogrammetry
- 1. MO73 Specific Gravity Measurements
- m. MO92 Facial Photographs
- n. MllO Hemoglobin Measurements
- o. Insensible Water Loss
- p. Visual Light Flash Phenomenon
- q. Pre- and Post-Exercise Muscle Girth Measurement
- r. Instrumented Exercise

Environmental microbiology met all requirements except for conducting the simulated illness event. The length of the illness event demonstration prohibited a successful scheduling opportunity among the other scientific mission demands.

Water sampling, taste and aroma evaluation, iodine monitoring,
CO monitoring, and atmospheric volatile concentration samples
were accomplished without any major deviations from the prescribed
mission requirements.

Considerable measurements were made of crew body size and configuration along with shifts of body masses, especially fluids. The former effects were accomplished with detailed limb volume measurements, IR photography, and stereophotography. The latter effects were measured with simple center of mass determinations. Except for stereo photos, at least four sets of measurements were relatively evenly distributed throughout the mission duration on each crewman. Stereo photos were taken on each crewman during the early and late stages of the mission. Documentary photographs were taken of limb volume and center of mass measurements during normal operations. Stereophotography and limb volume met 57% and 89% respectively of their pre-mission requirements. Performances were not always scheduled at optimal intervals.

Sweat samples were taken twice on each crewman to support mineral balance studies. While more samples were scheduled, the additional performances were deleted when crew time became critical.

Limb blood flow measurements were made at regular intervals across the length of the mission to support MO92 LENP findings. Facial photography planned in conjunction with LBNP was completed; however, the schedule was slightly modified when crew time became critical.

Hemoglobin and urine specific gravity measurements were made following M110 blood draws. Hemoglobin determinations were accomplished for all but the pre-recovery last blood draw. Urine specific gravity measurements were eliminated after the fourth blood draw when crew time became critical.

Insensible water loss, visual light flash phenomenon, and pre- and post-exercise muscle girth measurements were met; however, the light flash observations conducted during MD74 were so enlightening, they were repeated on MD81 for a one-hour period.

Instrumented exercise measurements were obtained during personal physical conditioning on the bicycle ergometer. These data were obtained approximately six times from each crewman at maximal ergometer work loads. The measurements supported MO93 and M171 findings.

Biomedical items stowed in a revisit bag consisted of rehydratable and thermostabilized foods, a bread package, pudding, a beverage, and a surgical glove. Other than two MO92 leg bands, several drug samples, and scheduled experiment or DTO specimens, no other biomedical items were returned.

12. Accomplishment Summary

Table 1.1 and Table 1.2 provide a general overview and success index of inflight medical experiments and special test accomplishments.

MEDICAL EXPERIMENTS ACCOMPLISHMENT SUMMARY

MEDICAL EXPERIMENT	SCHEDULE	ACCOMPLISHED	SUCCESS
M071			
Food Track	1/crewman/day	84/crewman	100%
Body Weight	1/crewman/day	83/crewman	99%
Fecal/vomitus	1/occurrence		100%
Urine Measurement	1/crewman/day	75/crewman	80%
H ₂ O Intake Measurement	l/crewman/day	84/crewman	100%
M073	and the second s		
Urine Sample	1/crewman/day	78/crewman	93%
мо74			
SMMD Cal	3 times	3	100%
мо78			
Not Required Inflight	N/A		
M092			
LBNP	26/crewman	67	86%
мо93			
Vectorcardiogram	26/crewman	63	81%
Mllo			
Blood Samples	8/crewman	24	100%
M131	1-1-3-1	(= 0 /= 0)	
-1 OGI/MS	(7/7)/crewman	(18/13)	74%
-2 Spat. Localization	3/crewman	9	100%
M133			
Sleep Monitoring	18 times/SPT	18	100%
M151			
Photography	30 activities	29	97%
M171			_
Metabolic Activity	12/crewman	12	100%
M172			
BMMD Cal	3 times	3	100%

Table 1.1

SPECIAL MEDICAL TEST ACCOMPLISHMENTS SUMMARY

# OIG	DESIGNATION	SCHEDULE	ACCOMPLISHMENTS	SUCCESS
20.10	Environmental Microbiology	5 performances	4	80%
20.16	Water Sample	H		100%
20.17	Iodine Monitoring	6 times	9	100%
20.18	Carbon Monoxide Monitoring	4 times	en .	75%
20.21	Taste and Aroma Evaluation	6 performances	9	100%
20.22	Food Package	Deleted		·
20.23	Atmospheric Volatile Concentrator	3 performances	.	100%
20.25	Limb Volume Measurements	18 performances	710	89%
20.25	IR Anatomical Photos	21 performances	18	86%
20.25	Center of Mass Measurements	12 performances	2	100%
20.27	Sweat Samples	9 performances	M	33%
20.28	Blood Flow in Limbs	21 performances	61	%06
20.29	Stereo photogrammetry	3 sets/crewman	2 sets/crewman	67%
20.31	Visual Light Flash Phenomenon	1 observation	Q	200%
N/A	MO73 Urine Specific Gravity Measurements	8/crewman	4/creman	50%
N/A	MO92 Facial Photos	21 sets	17 sets	81%
N/A	Mllo Hemoglobin Measurements	8/crewman	8/crewman	100%
N/A	Insensible Water Hose	2 perform/crewman	2 perform/crewman	100%
N/A	Pre- and Post-Exercise Muscle Girth Measurements	3 performances	Q	%19
N/A	Special Venous Compliance Tests	l performance		300%
	A Javu	c		

SECTION II

OPERATIONAL CHRONOLOGY SUMMARY

Table 2.1, Prime Crew Accomplishment Schedule, contains a chronology of medical experiment accomplishments.

A legend at the bottom of the table provides descriptive information about the status of each experiment run. The table itself can be used as an index for obtaining further detailed information about a given run. For example, the coded symbol (/) appears for an experiment. This symbol designates that while the performance was completed, data acquired from the run were unavailable at the time of this report. Having the experiment of interest, the crewman's "ID", and the day of interest, further details may be gathered from corresponding detailed tables appearing in Section III.

Table 2.2, Special Medical Tests and DTO Accomplishment Schedule, contains an inflight chronology of special medical tests.

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TABLE 2.1

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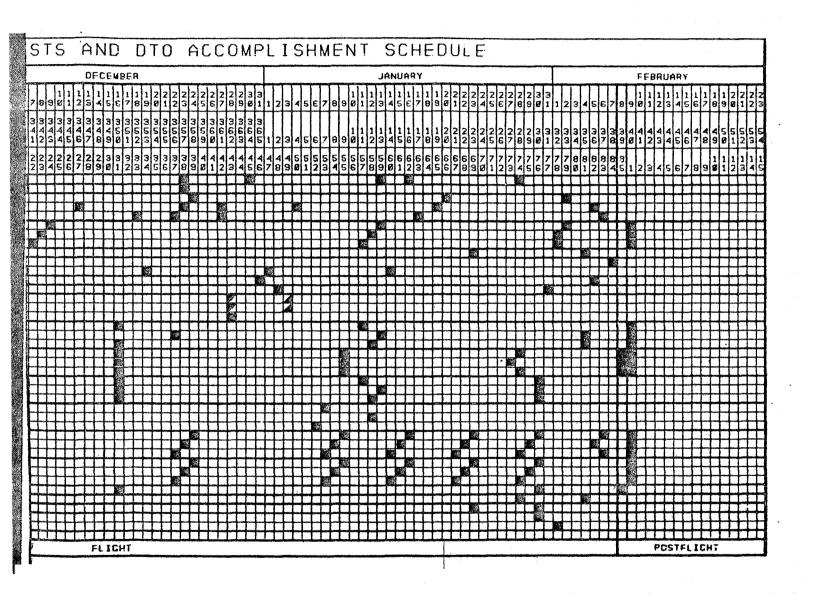


TABLE 2.2

SECTION III

MEDICAL OPERATIONAL REVIEW DETIALLED REVIEW OF EACH EXPERIMENT RUN

The tables appearing in this section are organized serially by experiment and subdivided by crewman. One table appears for each crewman within a given experiment.

The tables are divided into nine (9) categories which are defined as follows:

- was conducted within the constraints and general medical procedures for that experiment. Unsatisfactory, if a major portion of the experiment was omitted or accomplished so improperly that it is of no medical value and should be rescheduled.
- b) PROCEDURES: Nominal, if accomplished per the checklist.

 Deviated, if the procedure was changed prior to obtaining approval of the PCS/PI. Future use of an approved deviation will be classed as nominal.
- c) <u>CLINICAL FACTORS</u>: <u>None</u>, if the crewman involved has no health problems. <u>Significant Impact</u>, if there is reason to believe the crewman's health could have resulted in degraded experiment data.
- d) TIME REQUIRED: Nominal, if close to or less than that scheduled or expected. Above Nominal, if experiment required significantly longer time than expected.

- e) T/M QUALITY or SAMPLE QUALITY: Satisfactory, if telemetry reception was generally readable or sample quality was usable.

 T/M is mainly concerned with air to ground and ground station to JSC/MDRS terminal links. Unsatisfactory, if large batches of data or a sample were lost or unusable.
- f) T/M COVERAGE or SAMPLE QUANTITY: Satisfactory, if the air/
 ground data system was "up", for the entire duration of the
 experiment. Unsatisfactory, if data system was "down" or
 data dumps not performed properly. Sample quantity refers
 to the adequacy of the sample when applicable.
- g) EXPERIMENT HARDWARE: Satisfactory, if the crew was able to operate it satisfactorily and with the mandatory measurements operating. Unsatisfactory, if any major component of the equipment failed prior to the end of that run, even though a workaround was instituted.
- h) <u>DATA PROCESSING</u>: <u>Satisfactory</u>, if the data as received at the MDRS terminal was processed by CAAD in a format usable by the PI. Unsatisfactory, if the data could not be processed, or only such a small portion was usable as to make the experiment run useless.
- i) ANOMALIES/PROBLEMS: No. Documented, is a count of those listed by ISD. This does not include items opened by mistake based on misunderstandings. No. Closed includes those which have been adequately explained or acceptable workarounds arrived at.

Those for which the cause has not yet been explained are considered open. In some cases the close-out cannot be made until postflight data or sample analysis.

j) <u>SUMMARY: Acceptable</u> means that the PI considers that session as having produced enough useful data to satisfy the objectives of the experiment. An <u>unacceptable</u> run is one which is either obviously unusable or one which the PI decides is not usable after analysis of the data from the as-run protocol.

The latter part of this Section contains descriptive information of the special tests.

MO71 - MINERAL BALANCE

The MO71 experiment began 27 days prior to launch, continued throughout flight, and is scheduled to end 18 days after crew recovery at the time of writing, February 15, 1974, the postflight period in the 7th day.

Food intake monitoring has been complete, and within operational constraints, the intake of nutrients has been satisfactorily controlled. To meet the extended mission duration (56 to 85 days), a high density food diet was used to supplement the nominal Skylab menu. Water intake has been measured satisfactorily also.

Urine was collected and preserved satisfactorily throughout the duration of the experiment. (See MO73 Experiment - Bioassay of Body Fluids.)

Collection of fecal samples has been complete through this time.

During the inflight phase, these samples were measured for wet mass on the Specimen Mass Measurement Device. Subsequently, they were dried satisfactorily and returned to JSC for analysis.

Sweat samples were taken of each crewman and have not been unstowed.

These samples, along with special end-of-mission insensible water loss measurements, should provide additional data for the mineral balance studies.

Table 3-1 contains a review of MO71 data collection.

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^{#2 -} No Urine Measured or Sampled
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#4 - SPT's Sample not obtained

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#2 - No urine measured or sampled.
#3 - 36-hr. pool and sample.
* - UCTA used to return urine.

MO73 - BIOASSAY OF BODY FLUIDS

Preflight urine collections were accomplished satisfactorily for all crew members and the analyses have been completed. Four trays of urine and blood samples were received frozen from the SL-4 Command Module. These samples are still in the preparatory analysis stage. Post-flight collections are underway as planned.

Several inflight urine collection anomalies occurred inflight; however, they are not expected to degrade the experiment. On MD5, the SPT reported a leak in a large full sample bag. The SPT replaced the bag with the only spare available. The CDR's urine collection bag leaked on MD19 and caused approximately a 200 ml loss and forced a need for a volume determination from the lithium chloride additive. On MD62, the SPT's full sample bag broke and the sample was lost. On MD79, the PLT reported a 100cc spill when the boot on the urine collection bag failed.

To offset a possibility of losing frozen urine samples had the urine freezers malfunctioned, urine collection bags were charged with boric acid preservatives in pellet form. On MD16, the CDR reported undissolved pellets and expressed concern about getting solids in the dump lines. This was resolved as not being a problem, and probably due to boric acid concentrations being high in the immediate area of the disintegrating tablets. The same problem was reported by the SPT on MD22. Again, no further action was taken. The effect will be analyzed in the Endocrinology Laboratory with the returned sample.

The malfunctioning sample bags and the problem of insufficient spare created when the crew was unable to locate a complement of urine sample bags forced a compromise to the sampling schedule. It became necessary to implement a backup plan which alternated storage of 36-hour and 24-hour samples from the urine collection bags. The alternating schedule began on MD52 and extended for the remainder of the mission. Fourteen sets of crew urine samples were drawn from specific 36-hour collection periods. The modified schedule disrupted the planned ratio between full and one-half urine samples. Also, the rule requiring full urine samples on the days before, during, and after a blood draw was violated four times out of the eight blood draw days.

Urine specific gravity was measured coincident with the first four blood draws.

Table 3-2, a review of MO73 specimen collection, has been consolidated into Table 3-1, MO71.

MO74-SMALL MASS MEASUREMENT DEVICE

One calibration was routinely performed. Subsequently, all cal. masses were lost except for the 500 gm. mass. Two subsequent calibrations were not possible and a single point was recorded using the 500 gm. mass.

Operation was routine until MD 81 when the elastomer specimen hold-down attachment failed on the "head" unit (the same failure occurred in SMEAT) and the mission was completed with the wardroom unit.

Table 3-3 contains a review of MO74 data collection.

SUMMARY OF OPERATIONAL CHRONOLOGY

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^{#1 -} Zero Cal only
#2 - Waste Mgmt. Area only
#3 - Wardroom area only

^{#4 -} Lost all but 500 gm cal mass;0-500-0 cal #5 - 0-500-0 Cal #6 - Both facilities

MO78 - BONE MINERAL MEASUREMENT

Bone mineral content of the left os calcis and the right radius and ulna were measured on F-35, F-21, F-10, R+1, R+4 and scheduled for R+8. The results must await the R+8 data.

Table 3-4 contains a review of MO78 data collection.

SUMMARY OF OPERATIONAL CHRONOLOGY

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MO92-LOWER BODY NEGATIVE PRESSURE

Twenty-two inflight tests were conducted with the CDR and SPT and twenty-three with the pilot as subjects.

Prior to beginning MO92 runs on MD 5 each of the crewmen made daily left arm and left leg blood pressure measurements together with calf girth measurements of each leg. After the MO92 runs began, leg blood pressure measurements were continued through MD 16 and were subsequently deleted by the PI unless a crew health requirement should arise.

After the first set of runs, the PLT, SPT and CDR had early run terminations at the -50 mmHg level on MD's 10, 14 and 16 respectively. While the absolute causes for these early terminations are not evident, it was suspected that the crew had been experiencing early mission fatigue together with zero-g cardiovascular adaptation.

Neither the CDR nor the PLT had any further MO92 early protocol terminations; however, the SPT had two subsequent aborts on MD's 34 and 71. Each time these aborts occurred at -50 mmHg level and were attributed, at least in part, to fatigue caused by insufficient sleep.

During the time the workshop was experiencing high heat loads caused by peak sun exposure - between MD's 60 and 70, schedule adjustments were made to run MO92's early in the day when internal OWS temperatures were lowest and within environmental performance constraints. Some compromises had to be made to circadian objectives. These temporary compromises do not appear to present any insurmountable analytical problems.

On MD 30, the MO92 planning schedule was formally modified from 3⁺ 1-day intervals to 4⁺ 1-day intervals and effective through MD 56. This modification was necessary to accommodate high crew activity workloads. The reversion to the original scheduling interval occurred as planned.

As in prior missions, saddle positions had to be altered. The CDR, SPT, and PLT began the mission at saddle positions 7, 7, and 7, respectively. These were formally changed to 6, 6, and 6 on MD 23 and continued for the remainder of the mission.

On MD 10, the SPT's blood pressure measurements system stopped updating after the first few cycles. The crew was advised in real time. An onboard nitrogen valve was found closed. The valve was opened and the BPMS operated normally. Manual blood pressure readings were taken during this run.

During the PLT's MO92 run on MD 13, the VCG y and z axes were not transmitted due to a procedural error with a tape recorder switch. These data were lost for the entire run. Also on MD 13, during the CDR's MO92 run, the PLT reported a slow drift downward on the right leg band (AQ) calibration. This was corrected later by using the proper leg band and reference adapter combination. On MD's 30 and 31, the AQ right leg band displayed off-scale high on the front and end calibrations. Since this condition did not reappear on 17 subsequent runs. a procedural problem may have been responsible.

The AJ left leg band persistently exhibited off-scale high readings for the SPT and the PLT. The PI chose to change the calibration setting

on MD 53 to #2.0. The lowest setting the crew could use was #2.3 and that value was used for the PLT and SPT runs on MD's 53 and 54 respectively. Subsequently, the crew was advised to use calibration setting #2.5 which was more convenient operationally. This setting was used for the remaining mission duration and provided acceptable scale readings.

Ground data processing support was very good for the entire mission.

Table 3-5 contains a review of MO92 data collection.

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*To be discussed in 30-Day Medical Report.

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*To be discussed in 30-Day Medical Report.

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MO93 - VECTORCARDIOGRAM

MO93 was conducted independently nine times by original protocol and twelve times in conjunction with M171 on each crewman. The procedure for using M171 was an MRD option which was exercised by the Science Planning Team.

No operational events occurred which interferred with the collection of VCG data during scheduled MO93 runs and in conjunction with M171 runs.

Table 3-6 contains a review of MO93 data collection.

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*Bad Electrode Connection

M110 SERIES - HEMATOLOGY AND IMMUNOLOGY

Inflight blood samples were collected from each crewman on Mission Days 3, 5, 21, 38, 45, 58, 74, and 82. At the time of this report, the blood samples are still in the urine trays and have not been examined.

Hemoglobin determinations were made after every blood draw except the last. One additional finger stick measurement was made on MD 62. Laboratory evaluations will be made of the inflight blood specimens for comparisons with the inflight hemoglobin measurements.

There were some minor problem hemolyzing blood during the initial draws and this could have affected the amount and purity of samples returned. Detailed information should be available about day R+14, after the blood samples are examined.

One blood spacer was faulty and would not hold the ASP. This problem did not have any effect on the blood sample quantity or quality.

Table 3-7 contains a review of the M110 series data collection.

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Preflight data of sufficient quality and quantity were obtained on each of the SL-4 crewmen on all portions of the M131 experiment. These included measurements of semicircular canal response thresholds by means of the oculogyral illusion (OGI) basic susceptibility to motion sickness (MS) and spatial localization (SL).

Upon initial entry into weightlessness two of the crewmen experienced symptoms indicative of motion sickness with the most severe symptoms being manifested by the PLT. The CDR reported only a mild pre-meal epigastric awareness. Complete recovery from these symptoms occurred after approximately mission day 4 and from that point on all crewmen were dramatically free of symptoms as normally provoked by the M131 MS test protocol. By MD 12 all crewmen were able to perform the maximum required number of head movements (150) at the maximum rotating chair RPM (30) with no symptomatology. After MD 20 all MS testing was discontinued and not resumed again until approximately MD 73 at which time a special MS was conducted. This test required each crewman to first rotate CW for 150 head movements at 30 RPM and then immediately repeat the protocol with the direction of chair rotation reversed (i.e., CCW). The complete CW/CCW protocol was performed by all crewmen with no symptoms reported. During the mission a total of five MS tests were performed by the CDR and four each were performed by the SPT and PLT. (The special CW/CCW is considered one test.) A total of seven MS tests had been originally scheduled for each crewman

during the mission. On the OGI portion of the experiment the CDR's performance was very stable and he demonstrated a slight increase in ability to detect the illusion relative to preflight baseline performance. Relative to their preflight performance both the SPT and PLT demonstrated greater variability and a decrease in their ability to perceive the illusion. The greatest change was manifested by the PLT. Each of the crewmen performed a total of six successful OGI tests during the mission. A total of seven each had been originally scheduled.

As scheduled, a total of three complete SL tests were performed by each crewman. Preliminary analysis of these data indicate slight shifts in localization and slight changes in variability relative to preflight measurements.

When tested for post flight susceptibility to motion sickness in the rotating chair on R+1, R+2, and R+5, none of the crewmen experienced any significant symptoms. (All tests were at 30 RPM.) Additional tests will be required to determine the time course and completeness of return to preflight levels of susceptibility. As of this time, no significant changes relative to preflight baselines have been noted with either the OGI or SL tests; these tests, however, are not complete.

Table 3-8 contains a review of M131 data collection.

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*Special Double MS Run (CW + CCW Rotation)

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*Special Double MS Run (CW + CCW Rotation).

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*Special Double MS run (CW + CCW Rotation).

TABLE 3-8 (Cont'd)

M133-SLEEP MONITORING

The M133 Sleep Monitoring experiment was performed three times preflight, 18 times during the SI4 flight, and three times post flight by the Scientist-Pilot. On 17 of the inflight sleep monitoring nights satisfactory real-time data was obtained. On one night (MD 50), faulty data transmission resulted in the loss of approximately 75 percent of the real-time data for that night. Magnetic tape recordings were made of each inflight performance and these tapes were returned for post flight analysis by the Principal Investigator.

The M133 experiment was originally approved for SL-2 and SL-3 only, but was added to the SL-4 mission by the Flight Management Team approximately one month prior to the SL-4 launch. As only nine caps were available onboard, the experiment was approved for eight performances on the SL-4 flight; however, initial tests conducted by the SPT demonstrated that the caps could be reused successfully several times. As a result of these inflight tests, the FMT approved 10 additional inflight experiment performances.

The analysis of the SL-2 and SL-3 tapes confirmed that Tape Recorder #1 became inoperative during the SL-2 mission. Therefore, on the SL-4 mission, all inflight data were recorded on Tape Recorder #2 only. This necessitated a changeout of the magnetic tape by the SPT at the midpoint of the SL-4 flight.

Table 3-9 contains a review of M133 data collection.

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NOTES: #1 - Lost hour of data due to loose electrode.

#2 - Only received 2 hrs. of telemetry but tape may have good data.

ML51-TIME AND MOTION STUDY

Based on real-time crew reports, all but one inflight M151 requirement were satisfied. The lost filming performance was on an M509 Astronaut Maneuvering Unit activity. With the crew's cooperation, four additional photographic sessions were completed on combinations of M092/M093/M171 after Flight Management Team approval on MD 61.

There were some problems accomplishing the M151 schedule. The problems always arose from the cameras or the film transporters. Failures of either one of these devices occurred on Mission Days 6, 7, 14, 16, 20, 22, 23, 30, 33, and 45 and necessitated rescheduling M151 planned for those days.

On MD 27, plans were abandoned to photograph S183 and additional Earth Terrain Camera preparations were substituted for a total of seven runs.

All photographic data are being processed and no film quality assessments or analytical data are available for this report.

Table 3-10 contains a review of M151 data collection.

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*Extra Run for M151 (Not Planned).

NOTE #1: End of M092 run not filmed, per dump tape.
TABLE 3-10

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M171-METABOLIC ACTIVITY

The M171 experiment (metabolic activity) was performed 12 times on each crewman during SL4. This met the requirements set down prior to the mission. Vital capacity was determined prior to the start of each test protocol. Instrumented physical training was done as a crew option and data was obtained the following number of times on each crewman: CDR - (5), SPT - (7), and PLT - (6).

No significant anomalies were recorded on the matabolic analyzer or bicycle ergometer. Mode 2, nitrogen ratioing was utilized throughout all the tests, as planned.

BPMS and VCG data were obtained on all the runs.

Table 3-11 contains a review of M171 data collection.

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UNACCEPTABLE			L_	L	L,	_	_	L		<u> </u>			Щ	Ш	L		Ш		لبا	L_		L	<u> </u>					

M172 - BODY MASS MEASUREMENT DEVICE (BMMD)

The BMMD operated routinely for daily crew mass measurements and several extra body mass measurements associated with the insensible water loss study. No other use was made of the device and no other stability studies were done with it. Three cals. were performed with the same uncertainties of the cal. masses previously noted during earlier missions. The device remained extremely stable, but approximately 5 days prior to end of the mission the subject release mechanism failed. This unit had failed in the same mode on final ground cal/checkout. The remainder of the measurements were made with the calibration release mechanism. This procedure required the assistance of a second crewman.

Table 3-12 contains a review of M172 data collection.

MEDICAL EX	(PER	IM	ENT	М	1	7 3	2			· ·······									NO						
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c. NOMINAL d. DEVIATED			-	+	+		# <u>1</u> /	/	7	7														+	+
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e. NONE f. SIGNIF. IMPACT	+			+	F			N,	A														\Box	4	4
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DATA QUANTITY k. SATISFACTORY								Z	Ζ	Z													1	$\frac{1}{4}$	1
1. UNSATISFACTORY EXPERIMENT HARDWARE	+		1	\dagger	\dagger		4																7	十	十
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#1 - Zero Cal. Only.

SPECIAL TESTS

The following special medical tests and Detailed Test Objectives (DTO's) were performed during the course of SL-4.

- 1. Inflight Hemoglobin and Urine Specific Gravity Determinations
- 2. Instrumented Exercise Determination
- 3 Facial Photography
- 4. Atmospheric Volatile Concentrator
- 5. Environmental Microbiology
- 6. Water Sample
- 7. Iodine Monitoring
- 8. Carbon Monoxide Monitor
- 9. Taste and Aroma Evaluation
- 10. Girth and Weight Measurements and Crew Profile Photographs
- 11. Sweat Samples
- 12. Blood Flow in Limbs
- 13. Stereophotogrammetry
- 14. Visual Light Flash Phenomena
- 15. Insensible Water Loss
- 16. Pre- and Post Exercise Muscle Girth Measurements

Condensations of the test descriptions appear on subsequent pages.

Accomplishments have been summarized earlier in Tables 1.2 (page 12)

and 2.2 (page 15).

1. INFLIGHT HEMOGLOBIN AND URINE SPECIFIC GRAVITY DETERMINATIONS

The purposes of these tests are (1) to obtain inflight changes of hemoglobin level and urine specific gravity in comparison with pre- and post-flight data, and (2) to assess the accuracy of these measurements in weightlessness. These determinations were to be accomplished in conjunction with each M110 blood draw in flight.

2. INSTRUMENTED EXERCISE DETERMINATION

The value of personal exercise as a countermeasure to prevent cardiovascular and musculoskeletal deconditioning and to maintain crewmembers' fitness was postulated from the preceding two manned Skylab experiences. Quantification of applicable personal exercise (PT) and workload is technically difficult.

The purpose of this test is to obtain quantitative PT workloads utilizing the M171 ergometer and to assess daily and total personal exercise quantitatively in conjunction with work expended on scheduled M171 and M093 exercises.

3. FACIAL PHOTOGRAPHY

The purpose of this test is to obtain a series of facial photographies in conjunction with MO92 Lower Body Negative Pressure experiment to record acute and chronic changes of facial configuration and superficial venous filling caused by gravitational unloading, possible fluid shifts and eventual accommodations during the space flight.

4. ATMOSPHERIC VOLATILE CONCENTRATOR (MRD 20.23)

The purpose is to obtain samples and analyze the organic volatile

constituents from the SWS environment to assess a profile of the organic volatile constituents in the SWS using three Atmospheric Volatile Concentrator devices (AVC's).

5. ENVIRONMENTAL MICROBIOLOGY (MRD 20.10

The purpose is to obtain inflight microbial and fungus samples from SWS hardware and atmosphere in order to assess patterns of buildup or die-down of various strains. These data will be used for the development of preventive measures to control potential crew illnesses on future flights and to establish contamination control requirements for vehicular habitability.

6. WATER SAMPLE (MRD 20.16)

The purpose is to collect and analyze inflight water samples to verify the chemical quality of the water to assess the impact of the potable water constituents on Experiments MO71 (Mineral Balance) and MO73 (Bio-assay of Body Fluids), and to contribute to the development of future potable water supply systems.

7. IODINE MONITORING (MRD 20.17)

The purposes are to obtain inflight data on iodine concentrations in the orbital workshop (OWS) potable water system and inject

iodine, if indicated, to control biocidal activity to assure continuing water potability for protecting crew health.

8. CARBON MONOXIDE MONITOR (MRD 20.18)

The purpose is to determine whether there is a sufficient build-up of carbon monoxide (CO) in the cluster to interfere with the interpretation of medical experiment results or, in an extreme case, compromise crew safety.

9. TASTE AND AROMA EVALUATION (MRD 20.21)

The purposes of this inflight test are to obtain quantitative data on the possible diminution of the taste threshold during the space-flight, to gain a further understanding of physiological characteristics of man in flight and to formulate better food menus for future space flights.

The purpose was to obtain data on crewman body size and configuration changes during exposure to weightlessness by comparing inflight data with pre- and post-flight data. The methods used to determine relationships of the changes were multiple circumference measurements, center of gravity (mass) measurements, and infrared photography. This range of measurement techniques will provide a better understanding of early shifting of body fluids together with slower changes of body morphology and fat/muscle derangement.

11. SWEAT SAMPLES (MRD 20.27)

The purpose is to determine changes in the salinity of body sweat, to assess any change in normal sweat patterns which occurred under weightlessness, and to establish a relationship of these findings with disturbances of mineral balance mechanisms occurring on Skylab flights. The scheduling of this test was cancelled midway through the mission in order to save crew time for other activities.

12. BLOOD FLOW IN LIMBS (MRD 20.28) (CV #1 & CV #2)

The purposes of this special test are to provide additional information for the assessment of the cardiovascular state and deconditioning process, particularly in support of MO92 Lower Body Negative Pressure (LBNP) experiment. Test procedures and measurements will elucidate the factors of limb blood flow and the pumping action of muscles in the legs so that a better understanding can be attained about changes to the cardiovascular system during prolonged weightlessness and to explain changes to the cardiovascular system which affect its ability to tolerate lower body negative pressure stresses.

13. STEREOPHOTOGRAMMETRY (MRD 20.29)

The purpose is to obtain quantitative body volume data, to determine possible shifting of body fluids in weightlessness, and to determine if progressive changes occur over the period of a long duration flight.

14. VISUAL LIGHT FLASH PHENOMENA (MRD 20.31)

The purpose is to obtain additional data on the observation of light flashes in earth orbit to provide a better foundation for further investigative plans to ascertain if there is a latitude effect on the frequency of the flashes, causes of the phenomenon, (possibly Cerenkov radiation or HZE particles) and eventually to evaluate effects of this phenomenon to man's safety and health.

15. INSENSIBLE WATER LOSS

The purpose is to obtain data to assess insensible body water loss of the crew members during the spaceflight in conjunction with the crew members' intake and urine output in support of Body Fluid, Nutrition, Cardiovascular, and Metabolic Activity Experiments.

16. PRE- AND POST EXERCISE MUSCLE GIRTH MEASUREMENT.

The purpose is to obtain additional data of pre- and post exercise changes to limb girth as an adjunct to the anthropometric measurements (MRD 20.25).

SUMMARY OF DIFFICULTIES AND ANOMALIES

This section contains a tabulation of the difficulties and anomalies, together with the corrective action status, involved with the operation of each experiment. Equipment problems that were resolved prior to the start of an experiment are not included nor are telemetry and data processing problems which had workarounds. All hardware failures are tracked by an adequate tracking system and will be included in JSC's Skylab Mission Report for the third visit. Most of the problems included here are tracked by the Skylab Medical Anomaly Report system and are referenced here by the SMAR number. Other problems are documented in the minutes of the Medical Management Team where the PI's, PCS's, LSD Mission Managers, Biomedical Experiment Officers and Mission Surgeons reported problems daily, as soon as they were recognized.

SI-4

PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY EXPERIMENT NO. AND TITLE: MO73 BIO-ASSAY OF BODY FLUIDS

CATEGORY	DATE	PROBLEM DESCRIPTION	CORRECTIVE ACTION AND STATUS
Hardware	JD 324	Leak in urine sample bag.	SPT used another bag. (The Collection
1, 001)	30 OI 6		bags could be weighed in the BMMD and
(+90++			the sample omitted if the problem
			reoccurred).
Hardware	JD 338	Leak in urine collection bag	CDR replaced bag. Would result in an
(SMAR # 4-012)		around the rubber nipple (reused	incomplete 24-hour collection.
من من		. bag).	CLOSED
Expendibles	JD 335	Undissolved boric acid pellets	Believed to be due to lack of mixing in
(SMAK #	JD 341	noticed in urine collection bag.	o-g. No effect on mission, data or
4-012 <i>)</i>			other hardware.
Hardware	820 எ	Urine collection bag boot broke.	Lost a small amount of urine. No
(620-†		•	corrective action requested.
			ODEN

₹-TS

PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY EXPERIMENT NO. AND TITLE: M133 SLEEP MONITORING

TUS	cable. use.	eliminated led after lete data	CLOSED
CORRECTIVE ACTION AND STATUS	SPT replaced cable with a spare Problem attributed to extensive	Checking the cable connections eliminated the problem. Analog tape returned after the mission should have the complete data	so the run was considered acceptable
PROBLEM DESCRIPTION	Erratic readings prior to starting run when cable from sleep cap to preamp. was jiggled.	Telemetry lost after two hours of the run.	
DATE	υ 3 ⁴⁴	. 905	
CATEGORY	Hardware (SMAR # 4-017)	Hardware (SMAR # 4-023)	

SI-4

PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY EXPERIMENT NO. AND TITLE: MO74-SPECIMEN MASS MEASUREMENT

	CLOSED	rs lmost CLOSED
CORRECTIVE ACTION AND STATUS	No corrective action feasible or necessary. Calibrations run at 0-500-0 grams verified continued stability.	Wardroom SMMD was used. No repairs attempted since the mission was almost completed.
PROBLEM DESCRIPTION	All but one SMMD calibration weight (500 gm) reported missing	The curtain was reported separated from the frame of the SMMD in the Waste Management Compartment.
DATE	JD 358	ح350 مر
CATEGORY	PROCEDURAL (SMAR # 4-020)	Hardware (SMAR # 4-032)

7-TS

PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY EXPERIMENT NO. AND TITLE: MO92 - LOWER BODY NEGATIVE PRESSURE

Ş.		tem	last of			CLOSED	to 13	contact.	CLOSED	crew.			GLOSED
CORRECTIVE ACTION AND STATIS	ore of the sound	Crew opened the valve and the system	operated nominally during the las	the run.	Manual BP's were taken.		Crew readjusted the size from 14	to get better tongue and groove c		Explanation of error required to			TO.
MOTITAL METADAG	FROBLEM DESCRIFTION	BPMS not updating	During MO92 run on SPT, the blood	pressure stopped updating after the	first few cycles due to closed	nitrogen valve on panel 225.	Leg Band calibration drift downward	on the right leg band (AQ) during	calibration of MO92.	Sub Frame 3 data loss due to a tape	recorder switch in the wrong	position caused by crews' omission	of cue card verification in respect to Experiment 1 and Experiment 2
ንልሞድ	UMIE	JD 329					JD 332			332 ar	•		
VAMPAD	CAIEGORI	Procedural	(SMAR #	4-00k)			Procedural	(SMAR #		Procedural	(SMAR #	(600-4	

SI-4

EXPERIMENT NO. AND TITLE: MO92 - LOWER BODY NEGATIVE PRESSURE (Cont'd) PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY

PROBLEM DESCRIPTION OCHECTIVE ACTION AND STA luring electrode impedance lation checks. No corrective action was offered No corrective action was offered ressure Cuff S/N Oll failure; ressure Light or reading Octobered to S/N Ol2. No corrective action was offered The pressure Light or reading Octobered to S/N Ol2. Octobered to S/N				
and isolation checks. "spiking". No corrective action was offered in blood pressure Cuff S/N 011 failure; Crew switched to S/N 012. In blood pressure light or reading on S/N 011. On S/N 011. Tight leg band, S/N AQ, exhibited interface connector was found, be anomalies consisting of high off- scale and non-responsiveness of the to the reported anomalies.	CATEGORY	DATE	PROBLEM DESCRIPTION	CORRECTIVE ACTION AND STATUS
and isolation checks. No corrective action was offered Blood Pressure Cuff S/N Oll failure; Grew switched to S/N Oll. no blood pressure light or reading on S/N Oll. On S/N Oll. During MO92 run on SPT (JD 349) and A trouble-shooting attempted on 350 on CDR (JD 350), the reading of the No intermittency of the Y cable right leg band, S/N AQ, exhibited interface connector was found, be anomalies consisting of high off- scale and non-responsiveness of the to the reported anomalies.	Hardware	JD 334		
During Mo92 run on SPT (JD 349) and A trouble-shooting attempted on S/N O12. Tight leg band, S/N AQ, exhibited interface connector was found, becale and non-responsiveness of the to the reported anomalies.	(SMAR #		and isolation checks.	"spiking".
no blood pressure Cuff S/M Oll failure; Crew switched to S/M Ol2. no blood pressure light or reading on S/M Oll. (Pro- JD 349- During MO92 run on SPT (JD 349) and A trouble-shooting attempted on on CDR (JD 350), the reading of the No intermittency of the Y cable right leg band, S/M AQ, exhibited interface connector was found, be anomalies consisting of high off- operation has occurred 17 times scale and non-responsiveness of the to the reported anomalies.	4=0TT)			
During MO92 run on SPT (JD 349) and A trouble-shooting attempted on 5/N AQ, exhibited interface connector was found, be anomalies consisting of high off- special and non-responsiveness of the to the reported anomalies.				CLOSED
no blood pressure light or reading on S/N 011. (Pro- JD 349- During MO92 run on SPT (JD 349) and A trouble-shooting attempted on 350 on CDR (JD 350), the reading of the No intermittency of the Y cable right leg band, S/N AQ, exhibited interface connector was found, be anomalies consisting of high off- operation has occurred 17 times scale and non-responsiveness of the to the reported anomalies.	Hardware	348	Blood Pressure Cuff S/N 011 failure;	Crew switched to S/N 012.
on S/N Oll. During MO92 run on SPT (JD 349) and A trouble-shooting attempted on 350 on CDR (JD 350), the reading of the No intermittency of the Y cable, right leg band, S/N AQ, exhibited interface connector was found, a anomalies consisting of high off- operation has occurred 17 times scale and non-responsiveness of the to the reported anomalies.	(SMAR #		pressure light	
./Pro- JD 349- During MO92 run on SPT (JD 349) and A trouble-shooting attempted on 350 on CDR (JD 350), the reading of the No intermittency of the Y cable/right leg band, S/N AQ, exhibited interface connector was found, be anomalies consisting of high off- operation has occurred 17 times scale and non-responsiveness of the to the reported anomalies.	4-027)		on S/N Oll.	
During MO92 run on SPT (JD 349) and A trouble-shooting attempted on 350 on CDR (JD 350), the reading of the No intermittency of the Y cable, right leg band, S/N AQ, exhibited interface connector was found, be anomalies consisting of high off- operation has occurred 17 times scale and non-responsiveness of the to the reported anomalies.				CLOSED
on CDR (JD 350), the reading of the No intermittency of the Y cable, right leg band, S/N AQ, exhibited interface connector was found, be anomalies consisting of high off- operation has occurred 17 times scale and non-responsiveness of the to the reported anomalies.	Hardware/Pro-	-9 ⁴ 6 dt	During MO92 run on SPT (JD 349) and	A trouble-shooting attempted on JD 357.
right leg band, S/N AQ, exhibited interface connector was found, be anomalies consisting of high off- operation has occurred 17 times scale and non-responsiveness of the to the reported anomalies.	ceaure	350	$\overline{}$	No intermittency of the Y cable/legband
operation has occurred 17 times of non-responsiveness of the to the reported anomalies.	(SMAK # 4-018)	٠	g band, S/N AQ,	interface connector was found, but nominal
id non-responsiveness of the to the reported anomalies.				operation has occurred 17 times subsequent
		•	scale and non-responsiveness of the	to the reported anomalies.
せい しゅう しゅうしゅ しょうしゅ しょうしゅ しょうしゅ しょうしゅ しょうしゅ しょうしゅ しょうしゅ しょうしゅ しゅうしゅ しゅうしゅ しゅうしゅ しゅうしゅ しゅうしゅう しゅう			reading to the delts presente annitostion	CLOSED.

TABLE 4.4 (Cont'd)

SI.

EXPERIMENT NO. AND TITLE: MO92 - LOWER BODY NEGATIVE PRESSURE (Cont'd) PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY

ស្ត	stable	the	CLOSED	
CORRECTIVE ACTION AND STATUS	No action required because of a st	output obtained at rest and during the MO92 run.		
PROBLEM DESCRIPTION	AQ Leg Band intermittent indication	during gain adjust when the cable vas wiggled.		
DATE	JD 028			
CATEGORY	Hardware	(SMAR # 4-026)	-	

TABLE 4.4 (cont'd)

ST.-

PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY EXPERIMENT NO. AND TITLE: M110 - HEMATOLOGY AND IMMUNOLOGY

CATEGORY	DATE	PROBLEM DESCRIPTION	CORRECTIVE ACTION AND STATUS
Procedural	JD 322	Plasma sample had a slight pinkish	Procedures that could have caused
(SMAR # 4-001 and 4-004)		cast.	rupture of the red blood cells gere discussed with crew.
Procedural	JD 322	Blood sample coagulated in the	Crew was advised to agitate the syringe
(SMAR # 4-008)		needle and did not enter the ASP. Two ASP's were used and the sample	for better mixing of blood and anticoagulant.
		(JD 322, SPT) has some air in it.	CLOSED
Procedural	JD 324	Discovered that there was no	A syringe was used for early blood draws.
(SMAR #	-	vacuum source for evacuating the	Procedure sent to crew to utilizing
(000-+	•	ASP because of the LBNPD vent	available hoses with the proper QD's.
		modification.	
			CIOSED

TABLE 4.5

TABLE 4.5 (Cont'd)

ST

EXPERIMENT NO. AND TITLE: M110 - HEMATOLOGY & IMMUNOLOGY (Cont'd) PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY

rus	the ASP	CLOSED	
CORRECTIVE ACTION AND STATUS	SPT reminded not to overfill the	in case that was the cause.	
PROBLEM DESCRIPTION	SPT's plasma sample was a dark	yellow with a small amount of red in it.	
DATE	ക 365		
CATEGORY	Procedural	or Hardware Contamination (SMAR # 4-022)	

SI-

PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY EXPERIMENT NO. AND TITLE: M171 - METABOLIC ACTIVITY

NTUS	are.	CLOSED	se twice.	ird					CLOSED.		
CORRECTIVE ACTION AND STATUS	No action required to the hardware.	The system operated nominally.	Crew repaired the Mark I Exercise	No repair was done after the third	failure.						
PROBLEM DESCRIPTION	Pressure buildup in Spirometer due	to checklist error.	Mark I Exerciser Failure:	Recoil mechanism failed due to	broken recoil spring (JD 338 and	ന 028).	Mark I Exerciser return spring broke	again. (JD 034)	•		
DATE	න 323		338 338	and and	40 Up						
CATEGORY	Procedural	(SMAR # 4-006)	Hardware	(SMAR #	1-O-1						

TABLE 4.6

ST.

PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY EXPERIMENT NO. AND TITLE: M172 - BMMD

St	opera-	e. (An ave fixed rew).	CLOSED	
CORRECTIVE ACTION AND STATUS	Crew devised an alternate mode of opera-	tion using the calibration release. (An adjustment procedure that could have fixed the release was not sent to the crew).	- 51	
PROBLEM DESCRIPTION	M172 BWMD release intermittent			
DATE	JD 032			
CATEGORY	Hardware	(SMAR # 4-028)		

SI-4

PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY EXPERIMENT NO. AND TITLE: FOOD SYSTEM PERFORMANCE

	ATUS	were sent to	d to keep	ispenser	CLOSED	bly lid	CLOSED	nit adding	er bag	problem.			CLOSED.
	CORRECTIVE ACTION AND STATUS	Corrective action procedures we	the crew. Crew was also advised to keep	tape over syringe orifice and dispenser	bag valve.	Discarded can. Cause was probably lid	seam failure.	Crewman cut hole in bag to permit adding	water for rehydration. No other bag	reported with this water inlet problem.			
	PROBLEM DESCRIPTION	The salt dispenser nozzles plug with	the dried salt causing occasional	spills by squeezing of the bag.		Peanut Butter can leakage.		Apollo food bag split when the valve	did not function and caused water	pressure to split the valve of the	spoon bowl type rehydratable package	used inside the large food can.	
	DATE	JD 327				JD 341		JD 352			•		
,	CATEGORY	Hardware	(SMAR #			Hardware	(SMAR # 4-016)	Hardware	(SMAR #	(ATO-4)			

TABLE 4.7

SI.

PERFORMANCE DIFFICULTY AND ANOMALY SUMMARY EXPERIMENT NO. AND TITLE: FOOD SYSTEM PERFORMANCE (cont'd)

TUS	CLOSED	
CORRECTIVE ACTION AND STATUS		
CORR	Discarded.	
PROBLEM DESCRIPTION	Pineapple can leaked and the contents were spoiled.	
DATE	JD 035	
CATEGORY	Hardware (SMAR # 4-031)	

TABLE 4.7 (cont'd)